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HARVEY AS A HISTOLOGIST, AND CERTAIN LESS FAMILIAR FACTS IN HIS LIFE. *The Presidential Address for the Session 1908-9.* By D. FRASER HARRIS, M.D., B.Sc. (Lond.), F.R.S.E., *Lecturer on Physiology and Normal Histology, University, St Andrews.*

PART I.

HARVEY AS A HISTOLOGIST.

EVERYONE, except perhaps Maculay's schoolboy, knows that Harvey did not discover the histological connections between arteries and veins—the capillaries—for the excellent reason that he could not see them either with the naked eye or with the lens which we know that he possessed. But there is no possibility of doubt that Harvey believed that between arteries and veins there existed tubular structures, for in the letter to P. M. Slegel of Hamburg he clearly indicates that he does *not* support the notion of universal "transudation through the pores of the flesh." In this letter he speaks of visible arteries, as though there were arterial continuations which were *invisible*; and he also describes the blood as flowing "through other and yet other channels and *passages*." In fact, Harvey was perfectly aware that between arteries and veins there functionally existed structures invisible to the eye and inaccessible to the scalpel which were *not* mere arterio-venous anastomoses; *i.e.*, he knew of what we now call "arterioles and capillaries," but without having seen them.

We have his own assurance that he used a simple lens in his researches: he tried to be an histologist so far as lay in his power, or, more strictly, in so far as the power went under which he could lay certain objects. Now what did he see with his simple microscope? The answer is: (1) the heart beating *in situ* in certain transparent aquatic creatures; (2) the heart of the living embryo chick; and (3) certain vessels—the carotids—in the chick blastoderm.

I may at once say that Harvey had no idea of trying to seek for capillaries in dead (fixed) tissues. Even Malpighi did not first see capillaries in dead tissues by the use of any technique; he saw the blood in them first in the living frog-lung, apparently by reflected light. It evidently did not occur to Harvey to inject blood-vessels. Malpighi did, and so did Ruysch of Amsterdam (1638-1731) still more thoroughly.

Even had Harvey injected capillaries, and had his lens been sufficiently powerful to have resolved them for him, he could not have seen them unless he had virtually made "sections" of the tissues and clarified them—in fact, anticipated histological technique by about 250 years.

Nevertheless, Harvey did *not* rest content with what his unaided eyes could see; and I think this is all the more to his credit—he did scrutinise living organisms with his lens: of necessity these organisms had to be transparent or translucent. The word for the optical instrument which Harvey used is rendered "magnifying-glass" in the various translations of his works. The allusions to this are as follows:—

1. In chapter iv. of the *De motu* we have the expression "*ope perspicilli ad res minimas discernendas*" in a passage which is thus rendered in Willis's translation (p. 29): "Even in wasps, hornets, and flies I have *with the aid of a magnifying-glass*, and at the upper part of what is called the tail, both seen the heart pulsating myself and shown it to many others."

2. The second is also in the *De motu*, in the last chapter, the seventeenth, where the expressions "*aliquando ope perspicilli*" and "*illius specilli ope*" occur. The passage is thus rendered in Willis's translation (p. 76): "Still in bees, flies, hornets, and the like we can perceive something pulsating with the help of *a magnifying-glass*; in pediculi also the same thing may be seen, and, as the body is transparent, the passage of the food through the intestines like a black spot or stain may be perceived by the aid of the *same magnifying-glass*."

3. The third occurrence of this word is in chapter xvii. of the *De generatione*, where we have "*aut perspicilli ope*." The passage, a description of the heart and area vasculosa of the chick on the third day, is extremely interesting: "Nearly

in its centre there appears a leaping point of the colour of blood, so small that at one moment when it contracts it almost entirely escapes the eye, and again when it dilates it shows like the smallest spark of fire. . . . The above particulars you may perceive towards the close of the third day with very great attention and under the favour of a bright light (as of the sun), *or with the assistance of a magnifying-glass*; without these aids you would strain your eyes in vain, so slender is the purple line, so slight is the motion of the palpitating point."

4. The fourth mention of this word is in chapter xix. of the *De generatione*. Here Harvey is describing the chick as it appears on the seventh day of its development. The expression *perspicillis utenti* occurs; the passage is thus translated by Willis (p. 253): "If the head be removed, the vessels ascending to the brain may be observed as bloody points, with the use of *a magnifying-glass*."

Now what is this Latin word translated "magnifying-glass" in these passages? What is the nominative case of the word, oblique cases of which are "perspicilli" and "perspicillis," for the nominative does not seem to occur in either the *De motu* or the *De generatione*? In the first place, it need hardly be said, the word is not known to classical authors, though it is clearly derived from *perspicio*, "I look thoroughly into," "I peer into."

On consulting a dictionary of post-classical and late Latin terms (*Lexicon mediæ et infimæ Latinitatis*, 1858, compiled by l'Abbé Migue), I find a word "perspicilla" with a synonym "conspicilla" first used, it would seem, in 1539.

Is this "perspicilla" Harvey's word?

In the *Lexicon*, "perspicilla" is translated "bésicles" or "spectacles," as though "perspicilla" was a plural form. If it is, it must be a neuter plural of the second declension.

The nominative singular would therefore be "perspicillum," a form that does not occur in Harvey's writings; its genitive singular would be "perspicilli" ("ope perspicilli," by the aid of a magnifying glass), whereas its dative and ablative plural would be "perspicillis" ("utenti perspicillis," i.e. using magnifying-glasses).

This sentence from the *De generatione*, the fourth mention of the word, is, in fact, in Willis's translation rendered too freely; it seems to me that it ought rather to be: "The head having been cut off, there is, to one using magnifying-glasses, the appearance in the neck of veins like streaks of blood passing towards the brain" ("Abscisso capite, apparuit (perspicillis utenti) in cervice, venæ ad cerebrum ascendentis quasi punctum sanguineum"). "Utenti" is dative singular of "utens"; "utentis" is the present participle of "utor," which governs the ablative.

The Latin text I have used is *Gulielmi Harvei angli opera*, etc., Lugduni Batavorum, apud Johannem van Kerckhem, 1737.

PART II.

SOME LESS FAMILIAR FACTS CONCERNING HARVEY.

Certain facts in the life of William Harvey are very well known to those who know anything at all about the great High-Priest of English Biology; and this is as it should be.

The life of Harvey is interesting from several very different points of view—interesting both on account of what we know of it, and also on account of the many hiatuses its records contain.

Harvey demonstrated the one great fact in Biology which divides the physiologically dark ages from physiologically modern times; almost all his contemporaries disbelieved it, and during the rest of his life, *i.e.* from 1628, he strove by word, pen, and scalpel to justify the reality of his discovery.

But there is much about which we have no information. We have no details of his student life at Cambridge. Although we *have* a few other details of student life at Padua, we practically know nothing more of his election as a conciliarius or representative of the "English nation" at the University than the fact itself. We should like to know why, being an armiger, his stemma on the roof of the cortile of the quadrangle took the form not of his coat-of-arms but of the symbolical device of a torch with two serpents encircling it: perhaps, tantalising thought, his coat-of-arms was painted on that other tablet

which Professor Ferraris discovered only to confess it was decayed beyond restoration.

As to his various absences from London on journeys abroad we have but little information; we should like to know if he was in Scotland more than once—for once he certainly was—and what he did and saw in Spain in 1632; we should like to have his impressions of Cologne, of Nüremberg, of Ratisbon, of Florence, and, above all, of Rome.

How much would we give to have some account of his visits to certain of his well-known patients: James VI., Charles I. the Lord Chancellor Bacon, the Earl of Arundel, Prince Maurice the brother of Prince Rupert! How much more could some of his friends and contemporaries have given us than they have done of his private life and conversation: how tantalisingly meagre are John Aubrey, Hobbes, Hooke, Descartes, Bartholinus, all of whom allude to his work!

We would fain know him as he appeared to his pupils Scarborough, Highmore, and Willis, two of whom have left their names embedded in the terminology of English anatomy (as the “antrum of Highmore” and the “circle of Willis”): a greater than their own names could have so easily been enshrined in their writings had they given a thought to posterity.

Before we recount some of the little-known facts of Harvey's life, it might be well to make clear what exactly it was that Harvey did discover. In the first place, he recognised that the heart was *the* motive-power of the circulation: he was the first fully to appreciate the office of the heart in its dynamical relations to the vessels of the body. On this point his fore-runners had not had at all correct notions, a bellows-like action of the arteries, *e.g.*, having been supposed to suck in blood and force it out: the diastole of the arteries was supposed to be an active factor in filling the vessels with blood. In other words, Harvey's predecessors imagined arterial diastole to be an expansive “vital” act instead of a passive one on the part of the arteries. In the next place, Harvey asserted that the valves of veins were for the purpose of preventing regurgitation of the blood towards the periphery. Even Fabricius, his master in anatomy, who had studied the valves more closely than anyone else, had not come to this—the only

true—conclusion. Finally, Harvey demonstrated that it was the same blood which was pumped by the right side of the heart through the lungs that appeared in the cavities of the left side, whence it was forced onwards through all the arteries of every part of the body into the veins, whence it flowed into the right side of the heart.

But Harvey did much more than discover the mechanism of the circulation: he attempted, with all the assiduity of his nature, to discover the mechanism of reproduction and the development of the embryo. Inexorably hampered by having no microscope wherewith to explore the ultra-visible, Harvey nevertheless reached many conclusions which have stood the test of time. He insisted that the cicatrix was the precursor of the chick, that every living thing “came from” an egg, and he virtually enunciated the doctrine of Epigenesis. Not until 1827, and by von Baer, was the full truth of these things substantiated. Harvey wrote a great deal else: he had notes of post-mortem examinations and an exhaustive treatise on insects and their development which were destroyed when his rooms in Whitehall were ransacked by the soldiers of the Parliament in 1642. With regard to Harvey, most of us are content to agree with Bartholinus, that, “to have the glory of discovering the movements of the heart and blood was enough for one man.”

Amongst the less well-known facts in the life of Harvey, we would not be wrong in including the details of his absences from England. He was at Padua University from 1598 to 1602; in 1631–3 he travelled with the Duke of Lennox in Spain; in 1633 he was in Scotland; in 1636 he quitted England in company with the Earl of Arundel, bound for Vienna. They visited Cologne, Nuremberg, Ratisbon, Florence, and Rome; and finally, some writers have stated that Harvey was in Padua for the second time in 1637.

Of these various wanderings, Harvey's visit to Scotland must be for us, from a certain point of view, of considerable consequence. It cannot but be interesting to us who love “the grey metropolis of the North” to be told that, of the vast number of notable ones who have trod its steep streets, the immortal William Harvey was one.

There is no doubt whatever that Harvey was commanded by King Charles I. to accompany him to Scotland in the summer of 1633. Harvey, it must be remembered, was physician to the king, that is, had a Court appointment. When contemplating being away from London, Harvey had to apply for leave of absence from St Bartholomew's Hospital and to have a deputy appointed: there are records of these things having been done. Harvey was, in fact, one of the Court party in attendance on the king on his journey to Scotland for the purpose of being crowned at Edinburgh. He must have travelled in the Royal train, and in Edinburgh must of a certainty have lived in Holyrood House or quite close to it. Charles entered the city in state on 16th May 1633 by the "West Port" or "Gate" at the western end of the Grassmarket; the procession is known to have thence passed up the West Bow to the head of the Lawnmarket, and then down the High Street and Canongate to the Palace. Harvey must have traversed this route along with his Royal master. As the king remained in Scotland until 18th July, it is almost certain that his great physician lived about two months north of the Tweed.

Of this we have indirect evidence; for Harvey has left on record the appearance of the Bass Rock "during the months of May and June" in a description he wrote of that island, which he visited for the purpose of studying the development of the embryo in the eggs of the solan goose.

On 17th June Charles was entertained at a banquet given by the Earl of Mar in Edinburgh Castle, where the king slept that night. It is thus extremely probable that his physician was with him on this occasion, so that when we visit the banqueting-hall of the Castle, which has been so admirably restored, we see very much the same interior on which Harvey's eyes must have rested on that evening in June 1633. Next day there was a state procession down "the Royal Mile" to Holyrood, where the king was crowned in the Abbey Church, the so-called Chapel Royal: Harvey could not have been far away.

It is characteristic that he makes no allusion whatever in his writings to the religious controversies that at this time

were agitating Scotland. Harvey was apparently not one of those medical men who can take an interest in a great number of different subjects, such as was Dr Meade or Dr William Hunter in the eighteenth century and Sir James Simpson in our own day. Harvey's interests were entirely professional: he studied embryology when Charles and Laud were forcing Episcopacy on Scotland; he read Fabricius on generation during the battle of Edgehill.

It has been surmised that Harvey was again in Scotland with King Charles in 1639 and in 1641. It appears that he *was* present at the skirmish of Newburn-on-Tyne in 1640. Aubrey distinctly states that he had charge of the Royal children, afterwards Charles II. and James II., during the battle of Edgehill.

Of a second visit of Harvey to Padua (*cf.* Pye-Smith, *Ency. Brit.*, 9th ed.), viz. in the year 1637, when he is said to have demonstrated the circulation of the blood to Professor Vesling, I can find no corroboration.

It is believed that it was during his absence in 1636 with the Earl of Arundel that Harvey sat for his portrait to William van Bemmelen at Nuremberg. This portrait is the one in which the heart and arteries are displayed, as in a dissection, on the left of the canvas. The painting was engraved at Amsterdam by Houbraken in 1739: it was in Dr Meade's collection.

We are fortunate in possessing several portraits of our great countryman. The best-known is the oil painting by Cornelius Janssen (1590–1665), preserved in the upper library hall of the Royal College of Physicians, Pall Mall East. This portrait, gifted before 1666, represents Harvey as an old man with white hair, seated beside a pillar on his left. It was engraved by Hall. It faces the visitor coming into the room by the chief entrance; it survived the Fire of London. There is a replica of this portrait in the Hunterian Museum in the University of Glasgow; it formed part of Dr William Hunter's very valuable collection. Janssen is known to have made replicas of many of his works.

In the National Portrait Gallery, London, there is the head of an old man catalogued as a portrait of Harvey. This is the

head engraved as the frontispiece of the facsimile edition of the *De motu* published in 1894 by Moreton, Canterbury.

The Royal Society of London possesses another head of Harvey as an old man, attributed to de Reyn, (1610–78), which differs in several respects from the one just mentioned.

At Caius College, Cambridge, appropriately enough, there are two paintings of its greatest alumnus: one in the dining-hall, on the wall opposite the window, which seems to be a copy of the Janssen in London, while the other is a small head, very dark in treatment, in the newly panelled room off the Fellows' common-room. Except that this was gifted by the Earl of Leicester to the College in 1798, nothing further seems to be known of it.

There seem to be only two statues to Harvey in Great Britain: one is in London, the other in Folkestone. The former, larger than life, executed in 1876 by H. Weekes, R.A., was placed high up within the north portico of the building of the Royal College of Physicians; the latter, a colossal statue on a pedestal, was unveiled by Sir Richard Owen on 6th August 1881—the left hand holds the heart with the attached vessels. There are more busts than statues of Harvey, as one might expect.

Probably the bust to be regarded as the most important is on the wall near the Harvey chapel in the church at Hempstead in Essex where Harvey was buried. The late Sir B. W. Richardson believed, from its appearance viewed in profile, that this bust had been done from a death-mask; it is the least pleasing of all the likenesses of Harvey—a fact which of itself would agree with the idea that it presented a post-mortem appearance.

The College of Physicians possesses a marble bust at present in the upper library hall, the gift of Dr Meade in 1739.

Another bust is in the entrance hall below.

In the Fellows' common room at Caius College there is a bust which is a copy of that in the church at Hempstead.

Harvey may be said to have had distinguished friends, distinguished contemporaries at home and abroad, distinguished patients, correspondents, opponents, and pupils.

The following were a few of his *patients*:—King James VI., King Charles I., the Earl of Arundel, the Lord Chancellor Bacon, Sir William and Lady Sandys, a son of the Viscount Montgomery, Prince Maurice, and Sir Thomas Thynne. Of these, King Charles I. is probably the best known to us. His interest in Harvey's work was far from superficial. The king accompanied his physician when visiting a son of Lord Montgomery who had ectopia cordis: together they saw the heart beating *in situ*; together they found that when they touched it the youth was not aware of it unless he *also saw* them touch it. Harvey demonstrated to the king the chief phenomena of the circulation in living deer in the Royal Park at Windsor, and by aid of his "perspicilla" he showed him the beating heart of the embryo chick. King Charles was amongst the first of men to be told of the circulation of the blood in the new sense: his great subject apparently carried the king along with him through the various stages of the discovery. To Charles the *De motu* was dedicated. It is interesting for us to think that this saddest of English kings should have had his name in this way for ever associated with the greatest of English books.

Of Harvey's friends at home we may name the following:—John Aubrey the antiquary, the only person who wrote a contemporary account of him; Dr Argent; Sir George Ent, who was one of the company abroad with Harvey in 1636, and whom Harvey entrusted with the publication of the *De generatione*; Hobbes of Malmesbury, Hooke the natural philosopher, and Selden the lawyer. Dr Argent goes down to posterity immortalised, not because of anything he himself said or did, but because he, as President of the College of Physicians, is mentioned in the preface to the immortal *De motu*.

Both Hobbes and Hooke allude in their writings to Harvey's work. Hobbes mentions Kepler, Galileo, and Harvey as founders of the "New Philosophy," but does not include Bacon, to whose writings he makes no more than two passing allusions. Hobbes confesses that Harvey first gave an exposition of a "science of man." In his *De corpore* he attributes the beginnings of true natural philosophy to Copernicus, Galileo,

Kepler, Gassendi, and Mersenne, and of the "true science of the human body" to Harvey. Harvey is specially mentioned in the dedication of his *De corpore* as "the only man I know that, conquering envy, has established a new doctrine in his life-time."

While all this contemporary appreciation is a fact, nevertheless Hobbes did not comprehend the Harveian doctrine that the heart is the great central pump of the vascular system.

Robert Hooke, F.R.S., a contemporary of Harvey, mentions him specifically in the preface to his *Micrographia* thus:—"What a prodigious variety of Inventions in Anatomy has this latter age afforded, even in our own bodies in the very Heart by which we live and the Brain which is the seat of our Knowledge of other things. Witness all the excellent works of Pecquet, Bartholinus, Billius and many others, and at home of Doctor Harvey, Doctor Ent, Doctor Willis, Doctor Glisson." Invention is here used for discovery: Harvey himself writes: "Circuitus sanguinis a me inventus."

One of the most distinguished of Harvey's contemporaries abroad was certainly René Descartes. He was not a man prone to give other people credit for having discovered things, and yet he thus writes: "Do you not know in London a celebrated physician named Harvey, author of a book *De motu cordis et circulatione sanguinis*? What sort of person is he? As to the motion of the heart he has said nothing not found in other books, and I do not quite approve of it, but as to the circulation of the blood, *there* he has his triumph and the honour of first discovering it for which Medicine owes him much. He promised some other treatises; I don't know whether he has printed them. It is such works which deserve being read and not a number of big volumes which are mere waste paper." We may note in passing that Descartes does not here give the correct title of the *De motu* (*Exercitatio anatomica de motu cordis et sanguinis in animalibus*). Again, Descartes describes Harvey as "the English physician to whom belongs the honour of having first shown that the course of the blood in the body is nothing less than a kind of perpetual movement in a circle."

Harvey thus acknowledged Descartes' remarks: "When

the ingenious and acute Descartes (whose honourable mention of my name demands my acknowledgments) and others, having taken out the heart of a fish and put it on a plate before them, see it continuing to pulsate," etc. (second letter to J. Riolan). It is satisfactory to know that Descartes ultimately was completely converted to the Harveian view of the cardiac mechanism when once he had repeated Harvey's observations *in vivo*. In fact, he finally became an advocate of Harvey's views, and attacked Professor Plempius of Louvain, who had written against them.

I have called Harvey's correspondents "distinguished." Some of them were, for obstinacy in holding to Galenism and refusing to be convinced of any newer view. Of these, one of the most obstinate in his inconvincibility was Johannes Riolanus (John Riolan) of Paris, a man who was one year older than Harvey, but who died in the same year as he did, 1657. Riolanus, the younger, was Regius Professor of Anatomy and Botany in the University of Paris, and, as Harvey puts it, "first physician to the Queen, mother of Louis XIII." (Marie de Medici).

Besides writing two long letters or disquisitions on the circulation to Riolan, the first from Cambridge in 1649, Harvey met him at Whitehall, when he was in attendance on Marie de Medici, who was the mother of Henrietta Maria. But neither written nor spoken words could wean Riolan from his Galenism, and his last publication (*Encheiridium anatomicum et pathologicum*, 12mo, Parisiis, 1648) is, as Huxley vigorously put it, that of a "tympanitic philistine." Riolan was an osteologist and a botanist; he was the first professor at Paris to make an effort to establish the botanical garden there. Harvey is very polite to him; he calls him a learned, skilful anatomist, a most skilful physician, the Coryphæus of anatomists, and so on.

The close of the first letter is more than polite, for Harvey says: "The famous book will live for ever; and when marble shall have crumbled, will proclaim to posterity the glory that belongs to your name." A great anatomist need not always be a great prophet, apparently: for a thousand people who have heard of the *De motu*, we might find one that had heard of the *Encheiridium*.

The persons to whom Harvey wrote letters on professional subjects which have come down to us are only the following:—Caspar Hoffman, or Hofman, M.D., Paul Marquard Slegel, M.D., Giovanni Nardi, M.D., Robert Morison, M.D., John Daniel Horst, M.D., John Vlackveldt, M.D. The following persons were involved in the controversy that arose as to the “new doctrine,” or Harveian view of the circulation:—In England, James Primrose, M.D., and Sir George Ent, M.D.; abroad, René Descartes, Johannes Riolanus, Æmylius Parisanus, M.D., Johannes Veslingius, M.D., Vopiscus Fortunatus Plempius, M.D., Johannes Walaeus, M.D., Henry Leroy or Regius, M.D., and Werner Rolfink, M.D.

I take it, it would be affectation to suppose that we really know much about these men, who they were, or where they lived and worked. Of Caspar Hofman (or Hoffman) little is apparently known beyond the fact that he was a German, a Professor of the Theory of Medicine at Altdorf, a small town in Franconia which nevertheless possessed a University from 1623 to 1809.

Of Paul Marquard Slegel I can obtain no biographical fact whatever.

Giovanni Nardi, born in 1600 at Montepulciano, was a physician of literary tastes who lived in Florence. He had entertained not only Harvey on his Italian tour either on his way to or from Rome, but also some of Harvey's nephews. Among other publications of his we have *Lactis physica analysis*, Florence, 1634, and an edition (1647) of Lucretius' poem *De rerum naturæ*.

Robert Morison was a Scotsman, born at Aberdeen in 1620. When quite a young man he took up arms for the king, but, having to go into exile, he went over to France, where, after studying anatomy, botany, and medicine, he took his degree of M.D. at Angers in 1648 (the University here founded in 1246 ceased to exist in 1685). In 1650 Morison was made superintendent of the gardens of the Duke of Orléans at Blois. In this position he came under the notice of Charles II., who, about 1660, invited him to England. Here he was made not only physician to the king, but Regius Professor of Botany, with a salary of £200 a year and a house.

At the same time he was elected a Fellow of the College of Physicians. In 1669 he was appointed Professor of Botany at Oxford, which post he held till his death in 1683.

John Daniel Horst was a German who was born at Giessen in 1620 and died in 1685 at Frankfort-on-the-Main. He was the author of many books dealing with anatomy and medicine published at Ulm, Darmstadt, and Marburg. In course of time he became physician to the Landgrave of Hesse-Darmstadt. He resided at Darmstadt.

John Vlackveldt was a Dutch physician in practice at Haarlem.

James Primrose, M.D., was the son of a Scottish Doctor of Divinity, Gilbert Primrose, and grandson of Gilbert Primrose, M.D., of Culross, Fife, principal surgeon to James VI. This is the same family that gave rise to the noble house of Rosebery. James Primrose was born in France at St Jean d'Angély, took his M.D. degree at Bordeaux, and also the M.D. at Montpellier in 1617. In 1628 he took the degree of M.D. at Oxford. In December 1629, at Dr Argent's house, he was examined for his L.C.P., William Harvey being one of his examiners. He passed his examination and settled at Hull, where he practised medicine till his death in 1659. He was buried in Holy Trinity Church, Hull. Primrose was a voluminous but unoriginal writer. He published in 1630, in London, his *Exercitationes et animadversiones in Librum Gulielmi Harvæi de motu cordis et circulatione sanguinis*. At Rotterdam, in 1657, appeared his *Destructio fundamentorum Vopisci Fortunati Plempii*.

Sir George Ent was born at Sandwich in 1604, and died in 1689. He was buried in St Lawrence Jewry. He studied at Sidney-Sussex College, and later for five years at Padua, where he took his M.D. degree in 1636. He was an M.D. of Oxford. In 1665, on one occasion, after the anatomical lecture in Warwick Lane at which Charles II. had been present, the king knighted Ent in the Harveian Museum. Dr Ent was one of the original members of the Royal Society. He was the author of *Apologia pro circulationis sanguinis qua respondetur Æmilio Parisano*, London, 1641. Dryden, in his "Epistle to Dr Charleton," is said to notice the friend-

ship between Harvey and Ent, which was lifelong. The lines are :

“ The circling streams once thought but pools of blood
 (Whether life’s fuel or the body’s food)
 From dark oblivion Harvey’s name shall save,
 While Ent keeps all the honour that he gave.”

I confess this is really very bald as poetry, and obscure as information.

Harvey has certainly not inspired anything either graceful or vigorous in the way of poetry. Abraham Cowley has the following very poor stuff in his ode on Harvey :—

“ Thus Harvey sought for truth in Truth’s own book—
 Creation, which by God himself was writ :
 And wisely thought ’twas fit
 Not to read comments only upon it.

 Had Harvey to this road confined his wit,
 His noble circle of the blood had been untrodden yet.”

Dr Ent was President of the College of Physicians for six years in succession. Ent was of Flemish extraction, his father having taken refuge in England from the persecutions of the Duke of Alva.

Of Æmylius Parisanus very little has come down to our day. He seems to have been a Venetian physician who, in 1635, published *Lapis Lydius de motu cordis et sanguinis*, folio, Venet.

Considerably more is known of John Vesling or Johannes Veslingius of Padua. He was born at Minden in Westphalia in 1598, and died at Padua in 1649. As a young man he had travelled a good deal, and for some time had lived in Egypt and the countries of the Levant. Although appointed to the Chair of Anatomy at Padua in 1632, his interests were chiefly botanical. He was subsequently made Professor of Botany and Surgery. He resigned the Chair of Surgery in 1638, and gave his attention to the large and beautiful Botanical Garden at Padua, his catalogue of the plants there being published between 1642 and 1644.

In matters anatomical he chiefly studied the lymphatic

vessels in stomach and mesentery. His *Syntagma anatomicum*, published in 1641, passed through many editions.

John Evelyn, the diarist, records that when he visited Padua in 1645 he called on the Professor of Botany and Anatomy, a "Dr Veslingius."

Vopiscus Fortunatus Plempius was a Dutchman who was born at Amsterdam in 1607 and died in 1671. He was Professor of Anatomy at Louvain, where he wrote a good deal. His *Principles of the Institutes of Medicine* came out in 1638. He translated into Latin some of the writings of the Arabian doctor Avicenna.

Johannes Walaeus was Professor of Anatomy at Leyden; Henry Leroy or Regius was Professor of Anatomy at Utrecht; and Werner Rolfink was Professor of Anatomy at Jena.

We may now review very succinctly the historical order of the various attacks on the Harveian doctrine and the more important replies thereto. Although 1628 is the date of the publication of the *De motu*, it is absolutely certain that twelve years earlier Harvey was teaching the doctrine of the circulation, for notes of his lectures are yet extant, dated "1616," in which the essential facts are tabulated. In the dedication to Dr Argent and others he speaks of "having now for *more than nine years* confirmed these views."

The first counterblast was, one is sorry to say, by the Scotsman, Dr Primrose. It appeared in 1630, and is, according to Dr Pye-Smith, "a feeble tract." Primrose, who had been a pupil of Riolanus, remained a bigoted Galenist all his life. Harvey did not reply to this, probably for several reasons. Seeing that Primrose had only a year before he published his book received his L.C.P., and that Harvey was one of his examiners, Harvey probably felt he was too small an opponent to waste words on, particularly as his book contained no arguments drawn from the dissection or inspection of animals.

Five years later, a more lengthy but weaker attack appeared (1635), this time from Venice, in the *Lapis Lydius*, etc., of Parisanus. Again Harvey made no reply: the Venetian Galenist was not worth powder and shot any more

than the Scottish. Professor Vesling noticed these feeble protests, but they were soon forgotten.

The relationship of the German Vesling to Harvey may now be noticed. Two of Vesling's letters to Harvey have come down to our day, but Harvey's reply (to the first) has been lost. From all we can gather, Vesling had a real difficulty in accepting the Harveian view of the passage of the blood from the arteries into the veins, and that was the marked difference of the colour of the blood in arteries and in veins: if it was the same blood in both kinds of vessels, how came it to be red in one, purple in the other?

The physiology of 1640 was unable to show that this difference of colour was no proof that the blood in the arteries was not the same blood as in the veins. This difficulty of Vesling's was, however, a *real* physiological one, not an out-of-date *a priori* statement which had been repeated *ad nauseam*; Vesling had been thinking over things, and it seemed to him fatal to Harvey's view that the blood which was red in arteries should be purple in veins if it was the *same* blood. If we knew nothing about reduction of hæmoglobin in capillaries by tissues craving oxygen, this would be a difficulty to us still. It was a thoughtful difficulty, this of Vesling's, as contrasted with those which were merely frivolous or long ago solved. Dr Pye-Smith says that in 1637 Harvey, on a second visit to Padua, demonstrated the circulation to Vesling, who was not convinced for some years later still. Vesling was an honest doubter—a very different person from Riolanus—so that it is greatly to be regretted that Harvey's letter to him is lost.

In point of time, the objections by Caspar Hofman were before those of Vesling. Hofman's difficulty, while perhaps not exactly trifling, is antiquated in spirit; it is, that Harvey had made out nature to be a clumsy and inefficient artificer in causing the blood to return again and again to the heart in order to be "reconcocted." This objection we would now call teleological; and Harvey's reply virtually is that teleological difficulties must not prevent our drawing conclusions as to facts observable in the living animal. Blood keeps constantly pouring through the heart; that can be proved by vivisection: if we cannot explain why it does so, that must

not prevent our admitting that it does. Harvey, in effect, says, You must not weight your physiology with a teleological load.

Harvey's letter (to Hofman), dated Nüremberg, 20th May 1636, is a dignified entreaty that Hofman will repeat the necessary vivisections and so convince himself of what Harvey has urged. He begs him not to prejudge the new views until that has been done. There is a widely received belief that Harvey in Nüremberg in 1636 demonstrated his views to Hofman and others at a public dissection, and that the old Galenist was the only person present unconvinced. P. M. Slegel of Hamburg later dealt with Hofman, and believed that had he lived a little longer he would have died a Harveian disciple.

Descartes, in 1639, is the next contributor to the controversy, and his great weight is on the orthodox side. It is true that in his first allusion to Harvey's work he accepts the statements as to the "de motu cordis" but not "et sanguinis"; it is happily equally true that a little later he repeated Harvey's vivisectional experiments and admitted the truth of the whole of his doctrine. Further, he attacked V. F. Plempius of Louvain, who was a feeble objector.

In 1639 Professor Walaeus of Leyden suggested to an Englishman, Roger Drake, that he should take the new views of the circulation as the subject of his thesis for M.D. As Walaeus had adopted them, Drake's paper may be regarded as a contribution in favour of Harvey.

Henry Leroy of Utrecht was the next Continental professor to proclaim his adherence to the new physiology; following him came Slegel of Hamburg and Wolfink of Jena.

The date of the next publication is 1641, when Dr Ent's *Apologia pro circuitione sanguinis* appeared in London: this was an answer to Parisanus. Seven years later (1648), the tiresome Riolanus published his *Enchiridion*, as we have seen. To this Harvey replied in two tracts, both extant (the first dated Cambridge 1649), entitled *De circulatione sanguinis*. It was in the first of these that he used the expression "circuitus sanguinis a me inventus." Riolanus, it seemed, died unconverted.

1651 saw several contributions in favour of Harvey's doctrine.

Of course the most important is Harvey's own letter to P. M. Slegel of Hamburg; but in the same year Trullius, Professor of Anatomy at Rome, began to teach the new views, and Thomas Bartholinus of Copenhagen published his book, in the title of which he specifically mentions Harvey ("ad circulationem Harveianam"). About this time Pecquet of Dieppe, discoverer of the thoracic duct, publicly adopted Harvey's position.

The letter to Slegel is immensely interesting on account of two things discussed in it: (1) the question as to whether arteries are connected with veins by anastomosis or in some other fashion; and (2) the experimental evidence that the septum of the human heart is not pervious to blood, though Riolanus in his latest book had still maintained it to be porous.

As to arterio-venous anastomosis, Harvey admits that it is not the usual method of arteries becoming veins, for if so there would be "a *pulse* in the veins by reason of the continuity of parts." This is excellent physiology. One can here see that Harvey had reached the physiological conception of arterioles and capillaries or "invisible arteries"—tubes or communications in which the pulse was obliterated.

The second subject discussed in Slegel's letter is an interesting but very old one. It is the Galenical assertion that the septum ventriculorum is pervious to blood; but the tiresome Riolanus will not make an experiment to see if water will pass through from the right to the left side. Harvey describes what he did with the heart of a newly hanged criminal. The aorta is tied, a hole is cut in the left ventricle, all the vessels to and from the lungs are tied and water is forcibly injected into the right ventricle: result—not a drop of water crosses into the left ventricle, therefore the septum is *not* porous, and all those from Galen downwards who have said so are wrong.

In the next place, the transit from right to left side is *via* the lungs, for if the ligatures on the pulmonary vessels be untied and a tube be placed in the pulmonary artery and water injected into it, water (and blood) at once flows out of the hole in the left ventricle—in fact, an amount of water equal to that injected into the pulmonary artery. This is probably about the last contribution to the great subject from the pen

of Harvey himself; for his other letters—that to Dr Morison, the two to Dr Horst, and the one to Dr Vlackfeldt—are on the subject of the lacteal vessels or veins.

The first to Horst is dated February 1654, and contains the news of Slegel's death. He gives Pecquet high praise for his discovery of the thoracic ducts, but confesses it takes a mind free from care and very good eyes to make out these and similar tubes satisfactorily. Harvey makes a prophecy which has been abundantly verified in the interval between his time and ours: "Many things still lie hidden, . . . destined to be drawn up into the light by the indefatigable diligence of coming ages." The ages have indeed come, with their wonders untold and things undreamed of by Harvey.

Amongst other interesting people whom Harvey met was Wenzel Hollar, who was one of the Earl of Arundel's party in the tour of 1636. This Hollar was the well-known artist and engraver: some of the early views of Edinburgh and London were done by him. He was born at Prague in 1607, and died in London in 1677.

Several less familiar things in Harvey's life were quite unique: he made the post-mortem examination of old Parr, one of the oldest men of whom we have any record; his treatment of his own gout was quite unique; he was consulted on the subject of the guilt of the Lancashire witches; and, finally, he was buried in the most unusual manner, viz., his body was wrapped up in a leaden case instead of being put in a coffin. Harvey, in his note on the post-mortem of old Parr, says that he was a native of Shropshire, born near Winnington; that he died on 14th November 1635, having lived 152 years and nine months, and survived nine princes. He was brought to London by the Earl of Arundel to be shown to the king; and Harvey thinks that, as all his organs were healthy, the sudden change to the rich diet of Lord Arundel's establishment had proved too much for the old man's digestive powers. He had been blind for twenty years, but not deaf. Up to his hundred and thirtieth year he worked in the fields and thrashed corn. His memory, contrary to what usually happens in senility, was good for recent and not for remote events. His costal car-

tilages were not calcified, but were soft and flexible. In the light of the recent suggestion of Metchnikoff to treat intestinal putrefaction by cultures of the *bacillus acidi lactici*, the diet of old Parr is interesting.

The view is that this bacillus, through its product lactic acid, is inimical to the excessive growth of the bacilli of putrefaction in the intestines. By taking cultures of the *bacillus acidi lactici* we are thus saved from the absorption of anything like large quantities of products of putrefaction, blood-poisoning is thereby prevented, and long life guaranteed. Metchnikoff has pointed out that the inhabitants of some of the valleys of the Tyrol and of Bulgaria who live on sour milk are very long-lived. Now old Parr is a case in point. Harvey tells us his diet was "sub-rancid cheese and milk in every form; and small drink, generally sour whey." Of course, Harvey did not imagine this diet a good one: he thinks old Parr lived long in spite of it, not because of it, for he writes, "On this sorry fare . . . did this poor man attain to such length of days."

The story of the Lancashire witches throws a curious sidelight on the gross superstitions that could flourish in 1634 and engage the attention of the king, a bishop or two, a secretary of state, and the Lord Privy Seal. A boy playing truant from school in the woods in Lancashire swore that he had been carried off by a witch, Mother Dickenson. She carried him over fields and forests till she came to a barn where seven other witches were having supper. He said they assumed the shapes of all sorts of animals. This rigmarole contained a good deal else, all of which was believed. The king commanded the Earl of Manchester to order "Alexander Baker Esq. and Sergeant Clowes his Majesty's chirurgions" to get certain midwives to examine seven of the witches condemned to death to see whether on their bodies there were the "teats" of animals and other marks. The letter concludes: "The said midwives are to receive instructions from Mr Dr Harvey his Majesty's Physician and yourselves." They report that in Dr Harvey's presence, on 2nd July 1634, the examination was carried out, and that no unnatural marks whatever were found on their bodies. We have no scrap of evidence

to make us think that Harvey in any way shared in the popular superstitions as to these poor women: he merely carried out the Royal commands.

It is well known that Harvey towards the end of his life suffered from that aberration of metabolism said to be the disease of the intellectual hierarchy, viz. gout. His mode of treating his gout is not quite so well known. We have it on the authority of Aubrey that "he was much and often troubled with the gout and his way of cure was thus: He would sit with his legs bare though it were frost, on the leads of Cockaine House [his brother Eliab's town house], put them into a pail of water till he was almost dead with cold, then betake himself to his stove, and so 'twas gone."

With regard to diet, a point always of importance in gout, a statement has come down to us that contains more interest than appears on the surface. Harvey's great-niece told Dr Heberden in 1761 that Harvey in later life gave up the use of salt, filling his salt-cellar with sugar instead.

The view is gaining ground that gout in some of its polymorphic manifestations is associated with the retention of uric acid as urate of soda in the tissues. If we introduce into the body uric acid or urates, and also large quantities of sodium in the form of sodium chloride, we provide both constituents of this relatively insoluble salt, urate of soda. Gouty and rheumatic people are often very fond of salt; when they cut down their supply of common salt or, better, take a potassium salt instead, in very many cases they find the gout is alleviated, seeing that potassium urate is more readily eliminated. It is not straining things too much to believe that Harvey had come to the conclusion that he would be the better of no "added salt" in his diet.

The manner of Harvey's burial was unique, and is probably not a matter of common knowledge. He and several other members of his family were buried uncoffined, the body being rolled up in sheet-lead. I have seen these "mortuary cases" in the Harvey vault; they have a general resemblance to the outline of a body, and might be described as leaden mummy-cases.

Harvey was buried on 26th June 1657, the President and a

deputation of the College of Physicians being present, as was also John Aubrey the antiquary.

In 1847 the late Sir B. W. Richardson found the window of the Harvey vault broken and rain gaining access to the floor; the case containing Harvey's remains was cracked, and a frog was seen to jump out of it. In 1868 Sir Richard Quain examined the vault, and ten years later Richardson found the vault in a still more neglected condition. He obtained the permission of Dean Stanley to have the remains buried beside either Hunter's or Livingstone's in Westminster Abbey, but owing to the Dean's death this was not done.

At the expense of the Royal College of Physicians, a sarcophagus of white Sicilian marble was built in the north transept of the church, just above the vault; and on St Luke's Day 1883 (18th October) Richardson and seven other Fellows placed the shell in the sarcophagus along with copies of Harvey's works and other memorials.

In this north transept is to be seen the bust of Harvey, and beneath it a long inscription in Latin. I have never come across a translation of this inscription in any life of Harvey. Now, as it would be affectation to assume that we all can translate as we read these Latin inscriptions on tombstones, whether ancient or modern, I have thought it would be of interest to know exactly what was said of the great Anatomist and Physiologist by some contemporary inscription-writer, so I give a translation very kindly made for me by Professor Wallace Lindsay, M.A., LL.D., of the University of St Andrews:—

“William Harvey, to whose honourable name all Academies rise up out of respect, who was the first after many thousand years to discover the daily movement of the blood, and so brought health to the world and immortality to himself. Who was the only one to free from false philosophy the origin and generation of animals. To whom the human race owes its acquirements of knowledge; to whom Medicine owes its very existence. Chief Physician and friend of their Serene Highnesses James and Charles, monarchs of the British Isles, a diligent and highly successful Professor of Anatomy and Surgery at the College of Medicine at London, for them he

built a famous Library and endowed and enriched it with his own patrimony. Finally, after triumphal exertions in observation, healing, and discovery, after various statues had been erected to him at home and abroad, when he had traversed the full circle of his life, a teacher of Medicine and of medical men, he died childless on June the 3rd in the year of grace 1657, in the eightieth year of his age, full of years and fame."

